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Vegetative Growth and Yield Traits of 13 Local Papuan Sweet Potato (*Ipomoea batatas* L.) Accessions in Aimasi, Prafi District, Manokwari Regency

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A B S T R A C T

Sweet potato *((Ipomoea batatas* L.*)* is an important food crop for Papuan communities and exhibits high diversity among local accessions. This diversity may result in differences in growth and yield characteristics among accessions. This study aimed to analyze the vegetative growth and yield characteristics of 13 local Papuan sweet potato accessions cultivated in Aimasi Village, Prafi District, Manokwari Regency. The study was conducted from January to June 2025 using a randomized complete block design (RCBD) with 13 accessions and three replications. The observed traits included number of branches, vine length, vine diameter, number of leaves, aboveground biomass weight, total and marketable storage-root number and weight, storage-root diameter and length, dry matter content, harvest index, and productivity. Data were analyzed using analysis of variance followed by Duncan's Multiple Range Test (DMRT) at the 5% level. The results showed highly significant differences among accessions in vegetative growth traits and yield components. Madu Matawolot showed superior performance, with a productivity of 53.62 t ha^{-1}, a harvest index of 66.55%, total storage-root weight of 1.77 kg $plant^{-1}$, and marketable storage-root weight of 1.53 kg $plant^{-1}$. High vegetative growth was not always associated with high productivity. Based on the combined performance of productivity, marketable storage-root weight, harvest index, and dry matter content, Madu Matawolot, Sarmi-2, Amban Pantai-1, Sarmi-1, UM-2, and PPUS-1 performed relatively better and therefore have potential to be prioritized for further evaluation and selection

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INTRODUCTION

Sweet potato *(Ipomoea batatas* L.*)* is one of the important food crops in Indonesia and plays a strategic role in supporting food security. It has broad adaptability to various agroecosystems, ranging from lowlands to highlands. In addition to being a source of carbohydrates, sweet potato contains several beneficial nutritional components, including anthocyanins, vitamins, minerals, and phenolic compounds (Mustamu et al., 2018; Amagloh et al., 2021). For Papuan communities, sweet potato has a broader role because it is used not only as a staple food, but also as animal feed and as part of various social and cultural activities (Leurima et al., 2023; Paino, 2023).

The diverse agroecological conditions of Papua have contributed to the richness of local sweet potato germplasm with varied phenotypic characteristics and yield potential. This diversity can be observed in both vegetative growth traits and yield components. Vegetative characteristics such as vine length, number of branches, and leaf development contribute to canopy formation and determine the plant's capacity to intercept solar radiation for photosynthesis. Photosynthates are subsequently used to support plant growth and are allocated to storage organs in the form of storage roots. Therefore, vegetative growth characteristics are important for understanding a plant's capacity to produce storage roots (Pratiwi et al., 2025).

In addition to vegetative growth, sweet potato yield potential is determined by the plant's ability to initiate and develop storage roots. Important yield components include storage-root number, size, weight, and the weight of storage roots that meet marketable criteria. Studies on several local Papuan sweet potato accessions have shown broad yield variation, with storage-root weight per plant ranging from 0.60 kg to more than 6 kg (Restuono et al., 2020; Mustamu et al., 2021). This variation indicates the presence of potentially valuable genetic resources for selection and development of local sweet potato.

Although Papua has high diversity of sweet potato germplasm, quantitative information on vegetative growth characteristics and yield potential of local accessions under site-specific conditions remains limited, particularly in Aimasi Village, Prafi District, Manokwari Regency. Local accessions cultivated by farmers in this area are generally inherited and maintained across generations, but relatively few have been evaluated quantitatively for growth and yield traits. Consequently, information on accessions combining desirable growth with high productivity remains limited.

Evaluation of vegetative growth traits and yield components is needed to identify performance differences among accessions and to determine accessions with high yield potential under particular environmental conditions. Such information can also provide a basis for establishing selection criteria, supporting the utilization of local germplasm, and contributing to the conservation of Papuan sweet potato genetic resources (Sinon et al., 2025).

Accordingly, this study aimed to analyze the vegetative growth characteristics and yield performance of 13 local Papuan sweet potato accessions cultivated in Aimasi Village, Prafi District, Manokwari Regency. The results are expected to provide information on variation in growth and yield among

accessions and to serve as a basis for selecting promising accessions for development of local sweet potato in the Prafi area.

LITERATURE REVIEW

Sweet Potato and Its Role for Papuan Communities

Sweet potato *(Ipomoea batatas* L.*)* is an important root crop in tropical regions because of its adaptability to a wide range of environmental and agroecosystem conditions (Mustamu et al., 2021). It plays an important role as a food source by providing carbohydrates and several nutritional components, including anthocyanins, fiber, vitamins, and antioxidant compounds (Amagloh et al., 2021; Leurima et al., 2023). Beyond its food function, sweet potato also has social and cultural value for Papuan communities. It is used as an everyday food, animal feed, and as part of various local practices and traditions (Segenil et al., 2017).

Vegetative Growth of Sweet Potato

Vegetative growth is an important stage in canopy development and determines the plant's ability to intercept light and produce photosynthates. Traits such as vine length, number of branches, vine diameter, and number of leaves can be used to describe plant vegetative vigor. Well-developed canopies can increase photosynthetic capacity and provide assimilates that are subsequently used for growth and formation of storage organs.

Vegetative vigor is also related to a plant's ability to cover the soil surface and use available growing space. Optimal canopy development before and during storage-root formation can support the availability of photosynthates for plant growth. Therefore, vegetative traits can serve as indicators for evaluating performance differences among sweet potato accessions (Pratiwi et al., 2025; Hasan et al., 2019). However, vigorous vegetative growth does not necessarily indicate high storage-root yield. Assimilate allocation between vegetative organs and storage organs is one of the factors determining final yield. Thus, vegetative growth should be evaluated together with yield components to obtain a more complete picture of accession performance.

Yield Components and Sweet Potato Productivity

Sweet potato yield is mainly determined by the plant's ability to initiate, enlarge, and fill storage roots. Yield components commonly used to evaluate production include the number of storage roots per plant, storage-root weight, diameter and length, marketable storage-root weight, dry matter content, harvest index, and productivity. Variation in these components can lead to differences in productivity among accessions.

The number of storage roots formed is not always directly related to storage-root weight. Plants producing a greater number of storage roots may have lower productivity when most roots are small. Conversely, accessions producing fewer storage roots may achieve a greater total weight if they have a stronger capacity for root enlargement and filling. Therefore, yield evaluation should consider storage-root number together with size and weight (Restuono et al., 2020).

Yield variation has also been reported among local Papuan sweet potato accessions. Storage-root weight per plant in several local genotypes has been reported to range from 0.60 kg to more than 6 kg (Restuono et al., 2020; Mustamu et al., 2021). This diversity indicates genetic differences among accessions in storage-root formation and filling and offers opportunities to identify promising genetic material through selection.

Diversity of Local Papuan Sweet Potato Accessions

Papua is one of the regions with high sweet potato genetic diversity. This diversity is associated with geographical conditions, growing environments, and cultivation and selection practices maintained by local communities across generations (Sinon et al., 2025). Local accessions grown in different environments may consequently exhibit different growth and yield characteristics.

Agromorphological characterization and evaluation are required to assess variation among accessions and identify accessions with traits suited to particular environmental conditions. Site-specific evaluation, including in the lowlands of Prafi District, is important because expression of growth and yield traits results from interactions between genetic and environmental factors (Mustamu et al., 2021). Information on vegetative traits and yield components can provide a basis for identifying accessions with development potential. In addition to supporting selection and breeding, characterization contributes to the utilization and conservation of local Papuan sweet potato germplasm. Thus, evaluation of local accessions is important not only for identifying high-yielding planting material but also for maintaining genetic resources that have developed within local communities.

Relationship Between Vegetative Growth and Storage-Root Yield

Vegetative growth and storage-root yield are interrelated aspects of sweet potato productivity. Good vegetative growth enables development of a canopy capable of effective photosynthesis, whereas yield is determined by the plant's ability to allocate photosynthates to storage organs. Therefore, an appropriate balance between canopy growth and storage-root formation is important in determining productivity.

Accessions with vigorous vegetative growth do not necessarily achieve the highest productivity when a large proportion of biomass is allocated to vegetative organs. Conversely, accessions with moderate vegetative growth may achieve high productivity when storage-root formation, filling, and assimilate storage are more efficient. Accordingly, accession performance should be assessed through an integrated consideration of vegetative traits, yield components, harvest index, and productivity.

Evaluation of relationships between vegetative traits and yield components is important for defining selection criteria in sweet potato. Such information may help identify accessions combining desirable growth and yield characteristics and support the development of local sweet potato adapted to site-specific conditions. In this study, characterization of 13 local Papuan sweet potato accessions in Aimasi Village, Prafi District, is expected to provide baseline information for selecting promising accessions while supporting conservation of local germplasm.

METHODOLOGY

The study was conducted from January to June 2025 in Aimasi Village, Prafi District, Manokwari Regency. Planting materials consisted of stem cuttings from 13 local Papuan sweet potato accessions: Sarmi-1, Sarmi-2, Subsay-1, Subsay-2, Subsay-3, Koya-1, Koya-5, Koya-6, Madu Matawolot, UM-2, PPUS-1, PPUS-2, and Amban Pantai-1. Supporting materials included goat manure and NPK Mutiara 16-16-16 fertilizer. Equipment included an oven, scales, vernier calipers, measuring tape, a camera, and other supporting tools. The study used an experimental approach arranged in a randomized complete block design (RCBD). The treatments consisted of 13 local Papuan sweet potato accessions with three replications, giving a total of 39 experimental units.

Experimental Procedures

The field was cultivated, loosened, and leveled, after which raised beds were prepared at 30 cm height, 1 m width, and 4 m length. The distance between beds was 100 cm and the distance between replications was 50 cm. Goat manure was applied as basal fertilizer at 20 t ha^{-1}, whereas NPK Mutiara 16-16-16 was applied in split applications at 300 kg ha^{-1}. Apical vine cuttings approximately 25 cm long were planted at 50 cm spacing, with one cutting per planting hole. Crop maintenance included replanting missing plants, weeding, earthing up, irrigation, and vine turning. Harvesting was carried out at approximately four months after planting when plants showed signs of physiological maturity, indicated by leaves beginning to yellow and dry.

Observed Variables

Observations included vegetative growth traits and yield components. Vegetative traits consisted of number of branches, vine length, vine diameter, and number of leaves. The number of branches was counted at two months after planting. Vine length was measured from the base to the growing point, while vine diameter was measured at the middle section using a caliper. The number of leaves was counted from all fully expanded leaves. Yield components included aboveground biomass weight, total storage-root number, total storage-root weight, marketable storage-root number, marketable storage-root weight, storage-root diameter, storage-root length, dry matter content, harvest index, and productivity. Marketable storage roots were defined as roots weighing ≥150 g. Dry matter content was determined by oven-drying at 60 °C for 48 h or until constant weight was reached. Harvest index was calculated as the ratio of storage-root yield to total plant biomass. Productivity was calculated from storage-root yield per unit area and converted to t ha^{-1}.

Data Analysis

All observed traits were analyzed using analysis of variance (ANOVA) to determine the effect of accession on each variable. When significant differences were detected, mean separation was performed using Duncan's Multiple Range Test (DMRT) at the 5% significance level.

RESULTS AND DISCUSSION

Soil Conditions at the Experimental Site

Soil characteristics at the Aimasi experimental site at a depth of 20 cm, including analytical results, fertility criteria, land suitability classes, and their implications for sweet potato growth and yield, are presented in Table 1.

Table 1. Soil Fertility Status, Land Suitability, and Their Implications for Sweet Potato Physiology and Yield

Parameter	K-20*	Criterion**	LS***	Implications for sweet potato growth and yield
Texture	Silty loam		S1	Supports aeration, root respiration, and storage-root formation
Sand (%)	32			
Silt (%)	61			
Clay (%)	7			
pH (1:2.5 H_2O)	5.43	Acidic	S2	Reduces the availability of base cations
Organic C (%)	0.91	Very low	S3	Low soil organic matter may limit plant biomass production
Total N (%)	0.11	Very low	S3	May limit vegetative growth
C/N	8	Low	S3	Indicates a relatively unstable N reserve
P_2O_5 Olsen/Bray (ppm P)	42	Very high	S1	Supports root and storage-root development
CEC (me/100 g soil)	6.00	Low	S3	Nutrients are more susceptible to leaching
Ca (me/100 g soil)	1.72	Very low	S3	May limit optimal tissue development
Mg (me/100 g soil)	0.27	Very low	S3	May reduce photosynthetic performance
K (me/100 g soil)	0.15	Low	S3	May limit storage-root filling
Na (me/100 g soil)	0.21	Low	S3	Not considered limiting to growth
Base saturation (%)	39	Low	S3	May reduce nutrient-use efficiency

Note: * K-20 cm = concentration at 20 cm soil depth; ** fertility criteria based on Balai Penelitian Tanah (2005); *** LS = land suitability (FAO, 1976): S1 = highly suitable; S2 = moderately suitable; S3 = marginally suitable.

Soil analysis (Table 1) showed that the experimental soil in Aimasi had a silty loam texture and a pH of 5.43, indicating acidic conditions. Organic C (0.91%) and total N (0.11%) were very low, whereas available P was very high at

42 ppm. Potassium was low, as was cation exchange capacity (CEC), which was only 6.00 me 100 g^{-1}. Calcium and Mg contents were also very low. These conditions indicate several soil-fertility constraints at the site, particularly low organic matter, N, K, CEC, and base cations. Nevertheless, the silty loam texture was relatively favorable for aeration, root-system development, and storage-root formation. These soil characteristics should be considered when interpreting differences in growth and yield among accessions because plant trait expression results from interactions between genetic and environmental factors.

Analysis of Variance in Growth and Yield Traits

The analysis of variance for all quantitative traits of the 13 sweet potato accessions is summarized in Table 2.

Table 2. Analysis of Variance Summary for 13 Local Papuan Sweet Potato Accessions

Observed variable	Effect of accession	CV (%)
Vegetative components		
Number of branches	**	9.96
Vine length (m)	**	13.80
Vine diameter (mm)	**	7.79
Number of leaves	**	14.68
Yield components		
Aboveground biomass weight (kg)	**	7.33
Total storage-root number per plant	**	17.76
Total storage-root weight per plant (kg)	**	16.06
Marketable storage-root number per plant	**	17.41
Marketable storage-root weight per plant (kg)	**	18.49
Total storage-root number per plot	**	18.74
Total storage-root weight per plot (kg)	**	16.09
Marketable storage-root number per plot	**	17.41
Marketable storage-root weight per plot (kg)	**	20.00
Storage-root diameter (cm)	**	9.53
Storage-root length (cm)	**	6.79
Productivity (t ha^{-1})	**	16.09
Dry matter content (%)	**	3.92
Harvest index (%)	**	7.35

Note: * = significant ($p < 0.05$); ** = highly significant ($p < 0.01$); CV = coefficient of variation.

The analysis of variance (Table 2) showed that the 13 sweet potato accessions had highly significant effects ($p < 0.01$) on all observed vegetative growth traits and yield components. Coefficients of variation ranged from 3.92 to 20.00%, indicating that experimental variability remained within a range generally acceptable for field trials. According to Gomez and Gomez (1984), CV values ≤20% indicate good experimental precision. The results also demonstrate clear differences among accessions, as reflected in the variation observed in

vegetative growth, storage-root formation, storage-root quality, and productivity of the 13 local Papuan sweet potato accessions.

Vegetative Growth Characteristics

Results of the DMRT for number of branches, vine length, vine diameter, and number of leaves among accessions are presented in Table 3.

Table 3. Vegetative Growth Characteristics of 13 Local Papuan Sweet Potato Accessions

Accession	Number of branches	Vine length (m)	Vine diameter (mm)	Number of leaves
Sarmi-1	10 e	2.87 cd	3.9 de	167 b
Sarmi-2	7 g	4.89 a	2.9 g	103 d
Subsay-1	7 g	4.76 a	3.3 fg	105 d
Subsay-2	19 a	2.70 cde	3.2 fg	169 b
Subsay-3	7 fg	3.67 b	4.2 cd	113 d
Koya-1	11 de	2.26 de	3.9 de	119 cd
Koya-5	20 a	2.16 e	3.6 ef	216 a
Koya-6	9 ef	2.55 cde	3.9 de	128 cd
Madu Matawolot	16 b	0.96 f	4.9 ab	155 bc
UM-2	14 bc	1.22 f	4.7 abc	170 b
PPUS-1	11 de	3.02 c	4.2 cde	126 cd
PPUS-2	13 cd	1.38 f	5.2 a	136 bcd
Amban Pantai-1	13 c	2.59 cde	4.4 bcd	167 b

Note: Means followed by the same letter within a column are not significantly different according to DMRT at the 5% level.

The DMRT at the 5% level showed significant differences among sweet potato accessions in number of branches, vine length, vine diameter, and number of leaves (Table 3). This variation indicates differences in vegetative growth patterns among accessions that are likely associated with genetic factors and their interaction with the growing environment. Differences in canopy architecture may subsequently influence light distribution and photosynthetic efficiency.

Koya-5 and Subsay-2 had the highest number of branches, whereas Sarmi-2, Subsay-1, and Subsay-3 had the lowest. Koya-5 also produced the highest number of leaves (216), resulting in a relatively dense canopy. An excessively dense canopy may restrict light penetration into lower canopy layers (Liang et al., 2024); therefore, a larger canopy does not necessarily increase storage-root productivity. This pattern was observed in Koya-5, which exhibited vigorous vegetative growth but relatively low productivity (23.79 t ha^{-1}). In contrast, Madu Matawolot, with more moderate canopy development, produced the highest productivity. These results suggest that sweet potato productivity is more closely associated with efficient and balanced canopy development than with vegetative vigor alone.

Sarmi-2 had the longest vines (4.89 m), whereas Madu Matawolot had the shortest (0.96 m). Strong vine growth reflects high vegetative activity, but excessive canopy growth may increase photosynthate allocation to vegetative organs and potentially reduce allocation to storage roots. Nevertheless, Sarmi-2 still exhibited relatively high productivity, indicating that vine length cannot be used as a single predictor of productivity. Vine diameter also differed among accessions, with the highest value in PPUS-2 (5.2 mm) and the lowest in Sarmi-2 (2.9 mm). These differences indicate variation in stem growth characteristics, which, in addition to genotype, may also have been influenced by soil fertility. Low K content and cation exchange capacity (CEC) at the experimental site may constrain vegetative development and storage-root filling because K plays an important role in metabolism and photosynthate translocation.

Amban Pantai-1, Sarmi-2, Sarmi-1, Madu Matawolot, and Subsay-1 exhibited relatively more balanced canopy architecture than the other accessions. A more balanced canopy may allow more even light distribution and potentially improve photosynthetic efficiency (Tang et al., 2019; Zhang et al., 2023). In addition to genetic factors, acidic soil conditions and very low total N may also have affected leaf development and photosynthetic activity. Therefore, differences in productivity among accessions were associated not only with the magnitude of vegetative growth but also with the plant's ability to develop an efficient canopy and allocate photosynthates effectively to storage roots.

Aboveground Biomass and Storage-Root Formation Components

The highest aboveground biomass weights were recorded in PPUS-2 (1.93 kg plant^{-1}) and Subsay-1 (1.91 kg plant^{-1}). In contrast, the lowest values were found in Sarmi-2 (0.86 kg plant^{-1}) and Madu Matawolot (0.89 kg plant^{-1}) (Table 4). Differences in aboveground biomass indicate differences in biomass allocation among accessions. High aboveground biomass reflects greater accumulation in vegetative organs but does not necessarily result in greater storage-root yield. PPUS-2 provides a clear example because it had the highest aboveground biomass but relatively low productivity (22.93 t ha^{-1}), indicating that greater vegetative biomass does not necessarily reflect efficient storage-root production.

Table 4. Biomass and Storage Root Yield Characteristics of 13 Local Papuan Sweet Potato Accessions

Accession	Aboveground biomass weight (kg plant^{-1})	Total storage roots (plant^{-1})	Total storage roots (plot^{-1})	Marketable roots (plant^{-1})	Marketable roots (plot^{-1})
Sarmi-1	1.61 bc	4 d	77 d	3 bc	42 bc
Sarmi-2	0.86 g	5 bcd	98 bcd	4 ab	53 ab
Subsay-1	1.91 a	5 bcd	98 bcd	3 c	37 c
Subsay-2	1.71 b	5 abcd	112 abcd	4 bc	53 bc
Subsay-3	1.69 b	4 cd	84 cd	3 bc	40 bc
Koya-1	1.14 f	6 ab	133 ab	3 bc	45 bc
Koya-5	1.45 cd	6 ab	126 ab	3 bc	45 bc

Koya-6	1.24 ef	7 a	140 a	3 bc	45 bc
Madu Matawolot	0.89 g	7 a	147 a	5 a	68 a
UM-2	1.22 ef	5 bcd	98 bcd	3 bc	45 bc
PPUS-1	1.35 de	6 abc	119 abc	4 ab	54 ab
PPUS-2	1.93 a	4 cd	84 cd	3 c	37 c
Amban Pantai-1	1.24 ef	4 d	77 d	3 bc	42 bc

Note: Means followed by the same letter within a column are not significantly different according to DMRT at the 5% level.

The highest total number of storage roots was recorded in Madu Matawolot and Koya-6, each producing 7 storage roots plant^{-1}. At the plot scale, Madu Matawolot produced 147 storage roots and Koya-6 produced 140. However, a high number of storage roots did not always result in high storage-root weight. For example, Koya-6 produced many storage roots but had relatively low total storage-root weight and productivity. This indicates that storage-root size and filling capacity also determine final yield.

The highest number of marketable storage roots was recorded in Madu Matawolot, with 5 roots plant^{-1} and 68 roots plot^{-1}. These values indicate that Madu Matawolot was able not only to form many storage roots but also to produce a greater number meeting marketable criteria.

Storage-Root Weight and Marketable Yield

Madu Matawolot produced the highest total storage-root weight, at 1.77 kg plant^{-1} and 24.80 kg plot^{-1} (Table 5). These values were not significantly different from several other accessions with relatively high storage-root weight, including Sarmi-2, Amban Pantai-1, Sarmi-1, and UM-2. For marketable storage-root weight, Madu Matawolot again had the highest value, at 1.53 kg plant^{-1} and 21.45 kg plot^{-1}, followed by Amban Pantai-1, Sarmi-2, Sarmi-1, and UM-2. In contrast, the lowest marketable storage-root weights occurred in Koya-6 (0.68 kg plant^{-1}) and PPUS-2 (0.69 kg plant^{-1}).

Table 5. Total and Marketable Storage Root Weight of 13 Local Papuan Sweet Potato Accessions

Accession	Total root weight (kg plant^{-1})	Total root weight (kg plot^{-1})	Marketable root weight (kg plant^{-1})	Marketable root weight (kg plot^{-1})
Sarmi-1	1.57 ab	22.03 ab	1.39 abc	19.45 ab
Sarmi-2	1.67 a	23.38 a	1.43 abc	18.17 ab
Subsay-1	1.23 bcd	17.20 bcd	1.07 cde	15.02 bcd
Subsay-2	1.23 bcd	17.21 bcd	1.09 cde	14.84 bcde
Subsay-3	1.08 cd	15.14 cd	0.97 def	13.99 bcde
Koya-1	1.02 cd	14.21 cd	0.76 ef	10.17 cde
Koya-5	1.24 bcd	17.32 bcd	0.87 ef	12.24 cde
Koya-6	0.99 d	13.84 cd	0.68 f	9.52 de

Madu Matawolot	1.77 a	24.80 a	1.53 a	21.45 a
UM-2	1.51 ab	21.13 ab	1.35 abcd	20.31 ab
PPUS-1	1.37 abc	19.20 abc	1.13 bcde	15.88 abc
PPUS-2	0.90 d	12.58 d	0.69 f	9.17 e
Amban Pantai-1	1.62 ab	22.61 ab	1.48 ab	19.85 ab

Note: Means followed by the same letter within a column are not significantly different according to DMRT at the 5% level.

These results indicate that the ability to produce high total storage-root weight tended to be associated with increased marketable storage-root weight. However, the relationship was not always proportional because some accessions produced a considerable proportion of roots that did not meet marketable criteria. Therefore, selection of promising accessions should not rely solely on total storage-root number or weight but should also consider marketable storage-root weight.

Storage-Root Size, Dry Matter Content, Harvest Index, and Productivity

The analysis showed variation among local Papuan sweet potato accessions in storage-root size, dry matter content, harvest index, and productivity. The largest storage-root diameter was recorded in Sarmi-1 (10.6 cm), which was not significantly different from Amban Pantai-1 (9.8 cm) and UM-2 (9.3 cm), whereas the smallest diameters occurred in Koya-1 (6.2 cm) and Koya-5 (6.4 cm). For storage-root length, Amban Pantai-1 produced the longest roots (28.9 cm), not significantly different from Sarmi-2 (27.5 cm) and UM-2 (27.6 cm). In contrast, the shortest roots were found in Sarmi-1 (20.7 cm) and PPUS-1 (20.3 cm). Variation in root diameter and length indicates morphological diversity among accessions that is likely associated with genetic differences and plant responses to the growing environment.

Table 6. Storage Root Characteristics, Dry Matter Content, Harvest Index, and Productivity of 13 Local Papuan Sweet Potato Accessions

Accession	Root diameter (cm)	Root length (cm)	Dry matter (%)	Harvest index (%)	Productivity (t ha^{-1})
Sarmi-1	10.6 a	20.7 f	33.65 de	49.04 c	48.62 ab
Sarmi-2	9.1 bcd	27.5 ab	26.81 h	66.14 a	45.43 ab
Subsay-1	7.8 defg	25.7 bc	24.72 i	38.80 e	37.56 bcd
Subsay-2	8.1 cdef	22.4 def	34.15 cd	41.61 de	37.10 bcde
Subsay-3	8.4 bcde	22.2 def	28.84 gh	38.89 e	34.97 bcde
Koya-1	6.2 h	21.6 ef	36.86 ab	46.77 cd	25.44 cde
Koya-5	6.4 gh	24.9 bcd	29.66 fg	45.75 cd	30.59 cde
Koya-6	6.7 fgh	24.4 cde	35.98 bc	44.36 cde	23.79 de
Madu Matawolot	8.4 bcde	24.4 cde	22.23 j	66.55 a	53.62 a
UM-2	9.3 abc	27.6 ab	24.10 ij	55.40 b	50.78 ab

PPUS-1	8.8 bcd	20.3 f	38.65 a	50.92 bc	39.70 abc
PPUS-2	7.2 efgh	24.9 bcd	31.54 ef	31.44 f	22.93 e
Amban Pantai-1	9.8 ab	28.9 a	32.56 de	56.61 b	49.63 ab

Note: Means followed by the same letter within a column are not significantly different according to DMRT at the 5% level.

Storage-root size is one of the traits contributing to root weight and productivity. Differences in diameter and length reflect the capacity of each accession for storage-root formation and enlargement during the filling phase. Gurmu (2019) stated that storage-root diameter and length are associated with cell division and enlargement during root development. Larger roots have the potential to accumulate greater root weight because of their greater capacity to store photosynthates. The variation observed in this study is also consistent with Mustamu et al. (2021), Restuono et al. (2020), and Leurima et al. (2023), who reported substantial variation in storage-root characteristics among local Papuan sweet potatoes.

Dry matter content also differed among accessions. The highest dry matter content was recorded in PPUS-1 (38.65%), followed by Koya-1 (36.86%) and Koya-6 (35.98%), whereas the lowest was observed in Madu Matawolot (22.23%), followed by UM-2 (24.10%) and Subsay-1 (24.72%). High dry matter content indicates the ability of an accession to accumulate dry matter in storage roots. This trait is important because it is associated with starch content and root quality for fresh consumption and processing. Saraswati et al. (2013) reported variation in dry matter content among local Papuan sweet potatoes. Meanwhile, Zhou et al. (2023) and Jiang et al. (2024) explained that starch and dry matter accumulation are related to translocation of photosynthetic products from leaves to storage roots during the filling phase.

Interestingly, accessions with high dry matter content did not always produce the highest productivity. PPUS-1 had the highest dry matter content (38.65%) but a productivity of 39.70 t ha^{-1}, whereas Madu Matawolot produced the highest productivity (53.62 t ha^{-1}) with a dry matter content of only 22.23%. This indicates that fresh-root productivity and dry matter content are distinct traits and do not necessarily increase simultaneously. Productivity is more strongly associated with a combination of storage-root number, size and weight, and the plant's ability to allocate biomass to storage organs. Therefore, selection of accessions should be tailored to the intended use, whether for fresh-root production or for raw material requiring high dry matter content.

Harvest index represents the proportion of total plant biomass allocated to the economic organ, namely the storage roots. The highest harvest index values were recorded in Madu Matawolot (66.55%) and Sarmi-2 (66.14%), whereas the lowest occurred in Subsay-1 (38.80%). The high harvest indices of Madu Matawolot and Sarmi-2 indicate that these accessions allocated biomass to storage roots more efficiently than accessions with lower harvest indices. Conversely, a low harvest index indicates that a relatively larger proportion of biomass remained in vegetative organs.

The highest productivity was recorded in Madu Matawolot at 53.62 t ha^{-1} and was not significantly different from Sarmi-2, Amban Pantai-1, Sarmi-1, UM-2, and PPUS-1. The lowest productivity occurred in PPUS-2 at 22.93 t ha^{-1} and was not significantly different from Koya-6, Koya-1, Koya-5, Subsay-3, and Subsay-2. The high productivity of Madu Matawolot was supported by its high number and weight of marketable roots and its high harvest index. These results indicate that productivity is determined not only by vegetative growth but also by the plant's capacity to allocate photosynthetic products and biomass to storage roots.

The relationship between vegetative growth and productivity was evident in PPUS-2. This accession had relatively high aboveground biomass but low storage-root productivity. This pattern indicates that vigorous vegetative growth does not always result in high storage-root productivity because assimilates may be preferentially allocated to the formation and maintenance of vegetative organs. Low et al. (2020) reported that increases in vegetative biomass are not always accompanied by increases in sweet potato storage-root yield. In contrast, Madu Matawolot had relatively low aboveground biomass but the highest productivity and harvest index, indicating more efficient biomass allocation to storage organs.

Differences in accession performance may also be associated with the soil conditions at the experimental site. The soil had a silty loam texture, very low total N, low K, low CEC, and an acidic reaction. These conditions may affect vegetative growth, storage-root formation, and nutrient-use efficiency. Nitrogen plays an important role in vegetative biomass formation through chlorophyll synthesis and photosynthetic activity, whereas K is involved in photosynthate translocation and storage-root filling. Joko et al. (2024) reported the importance of N for vegetative growth in sweet potato, whereas Huang et al. (2025) demonstrated the role of K in photosynthate translocation and storage-root filling. Thus, low N and K availability at the experimental site may have contributed to differences in growth and yield among accessions.

Overall, Madu Matawolot, Sarmi-2, Amban Pantai-1, Sarmi-1, UM-2, and PPUS-1 showed relatively better performance based on the combined assessment of productivity, marketable storage-root weight, harvest index, storage-root size, and dry matter content. Madu Matawolot was the most prominent for productivity and harvest index, whereas PPUS-1 and Koya-1 were superior in dry matter content. Sarmi-1 had the largest storage-root diameter, whereas Amban Pantai-1 produced the longest roots. These different strengths indicate that no single accession was superior for all traits; therefore, accession selection should be based on breeding or utilization objectives. The six accessions could be considered for further evaluation across different environments to assess the stability of their agronomic traits and productivity.

CONCLUSIONS AND RECOMMENDATIONS

Highly significant differences were found among the 13 local Papuan sweet potato accessions for vegetative growth traits and yield components. Koya-5 and Subsay-2 had the highest numbers of branches, Sarmi-2 had the longest

vines, PPUS-2 had the largest vine diameter, and Koya-5 had the highest number of leaves. Madu Matawolot showed superior yield performance, producing 5 marketable storage roots plant^{-1}, total storage-root weight of 1.77 kg plant^{-1}, marketable storage-root weight of 1.53 kg plant^{-1}, a harvest index of 66.55%, and productivity of 53.62 t ha^{-1}.

Vigorous vegetative growth did not always result in high productivity because productivity was associated with biomass-allocation efficiency and with storage-root formation and filling. Based on the combined performance of productivity, marketable storage-root weight, harvest index, and dry matter content, Madu Matawolot, Sarmi-2, Amban Pantai-1, Sarmi-1, UM-2, and PPUS-1 showed relatively better yield performance than the other accessions and therefore have potential to be prioritized for further evaluation and selection as local Papuan sweet potato genetic resources.

FURTHER STUDY

As this study has limitations, further research is needed on the topic of "Vegetative Growth and Yield Traits of 13 Local Papuan Sweet Potato *(Ipomoea batatas* L.*)* Accessions in Aimasi, Prafi District, Manokwari Regency" to refine the findings and broaden the reader's understanding.

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